CLAIMS

1. A semiconductor-ferroelectric storage device, which comprises a transistor comprising a semiconductor substrate or semiconductor region having a source region and a drain region and, on which an insulator buffer layer, a ferroelectric film, and a gate electrode are layered in this order, wherein the insulator buffer layer is an insulating film comprising a hafnium-aluminum oxide as a main component.

2. The semiconductor-ferroelectric storage device according to claim 1, wherein x indicating the constitution ratio, $Hf_{1-x}:Al_{2x}$, between said hafnium element and said aluminum element in the insulator buffer layer is within a ratio of $0 < x < 0.7$.

3. The semiconductor-ferroelectric storage device according to claim 1, wherein the insulator buffer layer contains a nitrogen element as an additive.

4. The semiconductor-ferroelectric storage device according to claim 3, wherein the nitrogen element is contained in an amount of from 1×10^{19} cm^{-3} to 1×10^{22} cm^{-3}.

5. The semiconductor-ferroelectric storage device according to claim 1, wherein an oxide film, a nitride film, or an oxynitride film is inserted between the semiconductor substrate or semiconductor region and the insulator buffer layer.

6. A semiconductor-ferroelectric storage device, which comprises a transistor comprising a semiconductor substrate or semiconductor region having a source region and a drain region and, on which an insulator buffer layer, a ferroelectric film, and a gate electrode are layered in this order, wherein the insulator buffer layer is an insulating film comprising a hafnium oxide as a main component and contains a nitrogen element as an additive.

7. The semiconductor-ferroelectric storage device according to claim 6, wherein the nitrogen element is contained in an amount of from 1×10^{19} cm^{-3} to 1×10^{22} cm^{-3}.

8. The semiconductor-ferroelectric storage device according to claim 6, wherein an oxide film, a nitride film, or an oxynitride film is inserted between the semiconductor substrate or semiconductor region and the insulator buffer layer.

9. A process for producing a semiconductor-ferroelectric storage device, which comprises a transistor comprising a semiconductor substrate or semiconductor region having a source region and a drain region and, on which an insulator buffer layer comprising a hafnium-aluminum oxide as a main component, a ferroelectric film, and a gate electrode are layered in this order, said process comprising a treatment of a semiconductor surface, a formation of the insulator buffer layer, a formation of

the ferroelectric film, a formation of the gate electrode, and a heat treatment.

10. The process for producing a semiconductor-ferroelectric storage device according to claim 9, wherein the formation of the insulator buffer layer is conducted in an atmosphere comprising nitrogen gas.

11. The process for producing a semiconductor-ferroelectric storage device according to claim 9, wherein the atmosphere comprising nitrogen gas is a mixed-gas atmosphere comprising nitrogen and oxygen in a molar ratio of from 1:1 to $1:10^{-7}$.

12. The process for producing a semiconductor-ferroelectric storage device according to claim 9, wherein a substrate is placed in a vacuum vessel for thin-film formation, and the insulator buffer layer and the ferroelectric film are successively formed by vapor deposition without taking the substrate out of the vessel.

13. The process for producing a semiconductor-ferroelectric storage device according to claim 9, wherein a substrate is placed in a vacuum vessel for thin-film formation, and the insulator buffer layer and the ferroelectric film are successively formed by pulsed-laser deposition without taking the substrate out of the vessel.

14. The process for producing a semiconductor-ferroelectric storage device according to claim 9, wherein

hafnium and aluminum are simultaneously supplied to form the insulator buffer layer by vapor deposition.

15. The process for producing a semiconductor-ferroelectric storage device according to claim 13, wherein hafnium and aluminum are supplied from separate sources.

16. The process for producing a semiconductor-ferroelectric storage device according to claim 9, wherein hafnium and aluminum are each alternately supplied at least one time to form the insulator buffer layer by vapor deposition.

17. The process for producing a semiconductor-ferroelectric storage device according to claim 16, wherein the hafnium is supplied first.

18. The process for producing a semiconductor-ferroelectric storage device according to claim 9, wherein the heat treatment is conducted at least one time in any timing and environment selected from: in a vacuum vessel for ferroelectric-film formation during the formation of the ferroelectric film; in a vacuum vessel for ferroelectric-film formation after the formation of the ferroelectric film; in an annealing furnace after the formation of the ferroelectric film and before the formation of the gate electrode; and in an annealing furnace after the formation of the gate electrode.

19. A process for producing a semiconductor-ferroelectric storage device, which comprises a transistor

comprising a semiconductor substrate or semiconductor region having a source region and a drain region and, on which an insulator buffer layer comprising a hafnium oxide as a main component, a ferroelectric film, and a gate electrode are layered in this order, said process comprising a treatment of a semiconductor surface, a formation of the insulator buffer layer, a formation of the ferroelectric film, a formation of the gate electrode, and a heat treatment, wherein the formation of the insulator buffer layer is conducted in an atmosphere comprising nitrogen gas.

20. The process for producing a semiconductor-ferroelectric storage device according to claim 19, wherein the atmosphere comprising nitrogen gas is a mixed-gas atmosphere comprising nitrogen and oxygen in a molar ratio of from 1:1 to $1:10^{-7}$.

21. The process for producing a semiconductor-ferroelectric storage device according to claim 19, wherein a substrate is placed in a vacuum vessel for thin-film formation, and the insulator buffer layer and the ferroelectric film are successively formed by vapor deposition without taking the substrate out of the vessel.

22. The process for producing a semiconductor-ferroelectric storage device according to claim 19, wherein a substrate is placed in a vacuum vessel for thin-film formation, and the insulator buffer layer and the

ferroelectric film are successively formed by pulsed-laser deposition without taking the substrate out of the vessel.

23. The process for producing a semiconductor-ferroelectric storage device according to claim 19, wherein the heat treatment is conducted at least one time in any timing and environment selected from: in a vacuum vessel for ferroelectric-film formation during the formation of the ferroelectric film; in a vacuum vessel for ferroelectric-film formation after the formation of the ferroelectric film; in an annealing furnace after the formation of the ferroelectric film and before the formation of the gate electrode; and in an annealing furnace after the formation of the gate electrode.